DATA CENTER: COOLING AND THERMAL MANAGEMENT STRATEGIES

Improving Energy Efficiency in the Data Center

Consolidation, virtualization and deployment of high-density servers are causing changes to how data center operators manage power and cooling. The traditional approach to cooling a data center is to flood a room with cool air, which proves to be inefficient as the highest percentage of energy consumed is by the cooling infrastructure.

There have been significant advancements in thermal management strategies for a data center, such as software solutions called data center infrastructure management (DCiM), high-efficiency cooling solutions and containment strategies. The goal of these solutions or strategies is to efficiently provide enough chilled supply air to the IT equipment, while preventing any of this air mixing with the hot exhaust air within the data center.

Each data center layout is unique, and therefore may benefit from implementation of industry best practices and technologies such as:

- Air- or waterside economization
- Aisle and enclosure-based containment
- In-row or close-coupled cooling systems.

Industry Best Practices

Deploying industry-published and -proven best practices will increase energy efficiency in a data center. Even though some of these solutions are simple to deploy, taking a planned approach when implementing thermal management strategies and technologies is recommended:

- Create a hot- and cold-aisle layout to isolate chilled supply air from hot exhaust air. This strategy helps to reduce cooling costs and is ideal for low-density data center enclosures less than 4 kW.
- Use ventilated floor tiles that are kept at a minimum of 8 feet from CRAC/CRAH units.
- Implement overhead cable runs, which help to remove airflow restrictions and maintain the proper static pressure under a raised floor by not having to open the floor tiles.
- Seal cable cutouts to assist in positive underfloor pressure and limit air mixing.
- Install blanking panels and air dam kits in enclosures to promote front-to-rear airflow.
- Form a plenum air return back to the CRAC/CRAH units for hot exhaust air. Installing chimneys at the top of cabinets will help to guide the return air to an overhead plenum.

Economization: Free Cooling

Unless provisioned in the initial design of the data center, using free cooling is a large undertaking that requires a significant capital investment. The return on investment will come through energy savings realized by idling the chillers. Two types of economizers are used in free cooling:

- Airside: outside air is brought directly into the data center through filters or through heat exchangers.
- Waterside: water or glycol circulates directly through cooling towers rather than chillers or compressors.

Airflow Containment Strategies

One of the quickest ways to improve efficiency within a data center is through the deployment of a containment solution. Whether it's a hot- and cold-aisle layout or an enclosure-based solution such as a chimney, these technologies can provide an immediate ROI through energy savings by separating chilled supply air and hot exhaust air. Additionally, increasing data center temperature set points reduces energy consumed by the cooling system. Each degree raised can save up to 4 percent in energy costs.[1]

In-Row or Close-Coupled Cooling

An advantage of in-row cooling is that it moves the air conditioners closer to the IT load. By doing this, fans can operate at lower speeds because they do not have to drive the chilled supply air long distances to the IT equipment. It also shortens the returns for hot exhaust air. Decreasing fan speed by 10 percent can result in as much as a 27 percent reduction in energy use.[2] This technology is often deployed in performance optimized data center (POD) architectures, which are either hot-or-cold aisle containment solutions.

Industry Expertise

A well planned and executed thermal management strategy is essential to operating an efficient data center. By using well designed containment strategies combined with technologies and products such as in-row cooling, blanking panels, high-efficiency CRAC/CRAH units and sealed cable cutouts, you can generate long-term energy savings while providing a scalable and repeatable infrastructure to expand upon.

ANIXTER DATA CENTER HealthCheck℠

Anixter's technical experts can make recommendations on the latest products, technologies and best practices to improve your data center's efficiency. By scheduling a Data Center HealthCheck℠, you can have Anixter's data center subject matter experts assess the overall health of your data center.

[1] Energy Efficiency Guide: Data Center Temperature, Data Center Knowledge

[2] Ten Tips to Make a Legacy Data Center More Energy Efficient, Facilitiesnet

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